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THE COMPTROLLER GENERAL

11968

# Report To The Congress OF THE UNITED STATES

## Contracting For Computer Software Development--Serious Problems Require Management Attention To Avoid Wasting Additional Millions

Federal agencies often hire contractors to develop computer programs and associated documents. Many development contracts are successful, but some result in unsatisfactory or useless software.

Several causes of problems were common to all contracts GAO reviewed that encountered difficulties. This report recommends that the National Bureau of Standards and the General Services Administration issue specific guidelines to assist Federal agencies in recognizing and dealing with the unique problems of contracting for software development.



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FGMSD-80-4  
NOVEMBER 9, 1979

COMPTROLLER GENERAL'S  
REPORT TO THE CONGRESS

CONTRACTING FOR COMPUTER  
SOFTWARE DEVELOPMENT--MORE  
MANAGEMENT ATTENTION COULD  
AVOID WASTING ADDITIONAL  
MILLIONS

D I G E S T

Many Federal agencies have computer programs--called software in the data processing industry--developed by outside sources. These sources may be either private firms or other Federal agencies.

Although new software is often developed successfully by outside sources, GAO found that too many contracts experience large cost overruns and lengthy delays, and agencies may be dissatisfied with the product.

Agencies contract with outside sources for custom software development for various reasons. For instance, they do not have enough staff or expertise to develop it themselves, or they can get it at lower cost.

GAO sent questionnaires to 163 software contracting firms and 113 Federal project officers who had experience with software development contracts to identify what had caused trouble and what might be done to improve development efforts. Certain things causing problems for both contractors and agencies were common to all reviewed contracts that had trouble.

GAO examined nine cases of software development in detail. Eight had problems, but their overall performance cannot be taken as representative--some came to GAO's attention because they were failures. Nevertheless, the cases illustrated many of the same causes of difficulty that GAO's questionnaire respondents had identified.

Only one of the nine cases yielded software that could be used as delivered. The combined total costs and development times of

the nine cases increased from estimates of \$3.7 million and 10.8 years to an actual cost of \$6.7 million and an actual duration of 20.5 years.

#### COMMON CAUSES OF SOFTWARE DEVELOPMENT CONTRACTING PROBLEMS

Federal agencies contract for software development with little specific guidance. This circumstance was common to almost all reviewed contracts. (See p. 15.)

Agencies also overestimate the stage of system development they have reached before they contract. They overestimate the completeness of their own work, such as analyzing user requirements, before they contract for software development. Often, an agency's preliminary work is inadequate and must be done again by the contractor.

Overestimating its own preliminary work can lure an agency into issuing inappropriate contracts and using inadequate criteria for contractor performance. (See p. 17.) By failing to stipulate what constitutes satisfactory performance by the contractor, agencies reduce the likelihood that the delivered software will be satisfactory. The lack of a good contractual description of what the contractor is to do makes it difficult for the agency to claim poor contractor performance. (See p. 20.)

Agencies quickly overcommit themselves and fail to control contractors through strict phasing. They will sometimes commit themselves to the entire software development, including writing, testing, and delivering the computer programs before they even have the user requirements--what the software is to do--clearly identified. In such situations, a phased contract, initially committing the agency only to an analysis and design phase, and then proceeding only if the first phase proves satisfactory, would be much more suitable. (See p. 21.)

Agencies do not manage software development contracts during execution. Management failures while the work is being done included

excessive changes and afterthoughts, failure to inspect intermediate stages of the work, and failure to require progress reports from the contractor. In one case, officials stated that they could not review the work because it was being done on the contractor's premises. (See p. 23.)

In contracts that have problems, contractual testing requirements are often sketchy or absent. Agencies accept and pay for software without adequately inspecting and testing it. Contractors identified inadequate agency test data as a frequent source of problems. Failures to inspect test output and documentation products also occur. In one case, the contract called for the use of one programming language but the delivered programs were written in another. The contractor still got paid. (See p. 24.)

Some problems occur because agencies fail to establish a single focal point for communication with contractors. Communications difficulties and delays occur when contractors have no identified single source for answers or proposed changes and interpretations of requirements. (See p. 25.)

GAO also found that problems arise because agencies do not adequately specify or enforce contract clauses for recovery in the event of poor performance by the contractor, and contractors frequently fail to provide adequate software documentation.

#### RECOMMENDATIONS

GAO recommends that the Secretary of Commerce, through the National Bureau of Standards, and the Administrator of General Services issue specific guidelines to assist Federal agencies in recognizing and dealing with the unique factors added to custom software development when it is done by contract. The following areas should be covered:

- Internal agency management practices necessary to write, manage, and monitor software development contracts.

- Specific instructions on how to tailor software development contracts to the state of system development that an agency is in at the time it lets a contract.
- Guidance on contract stipulations regarding the phasing of the software development.
- Guidance on the review and approval procedures agencies should follow at the end of each phase of software development.
- Guidance on performance specifications to be included in the contract to clarify quality requirements for the software.
- The importance of requiring the software contractor to have a formal quality assurance program that is documented and subject to audit.
- The degree of definition required to properly define such things as (1) documentation standards, (2) adherence to programming language standards, (3) acceptance testing procedures, and (4) satisfactory performance by the contractor.
- How to handle changes in the software being developed with minimal disruption.
- How to ensure that the contractor follows sound system development practices.
- The effective use of contract clauses which would deny payment in case of poor performance by the contractor.

The above recommendation could be achieved to a large extent if the National Bureau of Standards and General Services Administration designed a series of model contracts containing detailed clauses on such items as documentation, phasing, and testing. A full explanation of their need and value should accompany these clauses. Agencies could extract relevant clauses and construct contracts to fit their particular situations. Such model contracts are recommended primarily as aids to agency software development

contract management, but they would also aid the agency procurement function in general.

GAO also recommends that Federal agencies involved in software development contracting train project managers in such overall skills necessary to manage those contracts as software, contracting, and management. Agencies should also take appropriate action in each phase of software development contracting. GAO offers a provisional checklist for contracting for software development to outline appropriate action to be taken for each phase (See app. I.)

In written comments on the report, the General Services Administration and the Department of Commerce generally agreed with the conclusions and recommendations. (See p. 31.)